(3Hours) [Total Marks :80]

N.B.:— (1) Question no. **1** is **compulsory**.
(2) **Attempt** any **three** questions out of **remaining five** questions.
(3) Assume suitable data if **necessary**.

1. Attempt any **five** of following:—   20
   (a) Explain shaping machine with neat diagram.
   (b) Differentiate between open loop and closed loop systems in CNC machines.
   (c) Draw two dimensional tool dynamometer and explain its features.
   (d) Show that in metal cutting Vc=V ×rc
   (e) Write a note on lubrication effects of cutting fluids.
   (f) Explain orthogonal rake system in detail.

2. (a) Explain the design procedure for a broach tool with help of diagram.   10
   (b) Write a note on cutting tool materials.   10

3. (a) With the help of neat sketch describe vertical machining centres.   10
   (b) Derive an expression for optimum cutting speed and tool life for minimum cost and   10
   maximum production rate. Also show that optimum cutting speed for maximum
   production rate is always more than optimum cutting speed for minimum cost.

4. (a) In an orthogonal cutting setup, the depth of cut was 10 mm, feed =1mm/Rev: 10
   cutting spped is 60 r.p.m. back rake angel =10°, chip thickness ratio=0.33, shear
   stress of material at zero compressive stress =1000kg/sq.cm. Assume that value of
   constant 'K' in equation 2ø+β- α=cot⁻¹ k, is 0.2. Calculate the resultant force, rate
   of metal removal. Shear strain, H.P at the tool per cubic cm of metal removal/ minute.
   (b) Explain milling machines in detail.   10

5. (a) How is gear manufacturing done? Explain in detail.   10
   (b) Derive the original Merchants theory along with diagram and assumption.   10

6. Write short notes on:—   20
   (a) Tool wear.
   (b) Form tool design.
   (c) G.M. codes in C.N.C. machines.
   (d) Carbide tool inserts.

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